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ABSTRACT

This research illustrates how statistical analysis of data was presented by the plaintiff's attorneys as evidence in litigation involving sexual and racial discrimination in the case Green v. City of Gadsden. Bar graphs depict the sexual and racial compositions of (1) members of the Gadsden Police Department (GPD), (2) members of the GPD in relation to their respective group within the Gadsden, Alabama population based on the 1980 census, (3) examinees taking the GPD written examination from 1980 to 1982, (4) examinees passing the GPD exam during the aforementioned years, (5) all applicants employed with the GPD from 1980 to 1982, (6) only applicants passing the GPD exam from 1980 to 1982 employed with the GPD during these years, as well as (7) all applicants offered employment with GPD from 1980 to 1982, and (8) only applicants passing the GPD test from 1980 to 1982 offered employment with the GPD during these years. Additionally, a table which exhibits several frequency distributions primarily indicating the number of individuals by sex and race obtaining a specific passing score that were hired is included. (Author/PN)

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The Presentation of Statistical Analysis of Data as Evidence in Litigation Involving Sexual and Racial Discrimination

Presented at the Annual Meeting
of the
Mid-South Educational Research Association

by
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Abstract

Bar graphs depict the sexual and racial compositions of (a) members of the Gadsden Police Department (GPD), (b) members of the GPD in relation to their respective group within the Gadsden, Alabama population based on the 1980 census, (c) examinees taking the GPD written examination from 1980 to 1982, (d) examinees passing the GPD exam during the aforementioned years, (e) all applicants employed with the GPD from 1980 to 1982, (f) only applicants passing the GPD exam from 1980 to 1982 employed with the GPD during these years, as well as (g) all applicants offered employment with the GPD from 1980 to 1982, and (h) only applicants passing the GPD test from 1980 to 1982 offered employment with the GPD during these years. Additionally, a table which exhibits several frequency distributions primarily indicating the number of individuals by sex and race obtaining a specific passing score that were hired.

This research illustrates how statistical analysis of data was presented in the case, Green v. City of Gadsden, by plaintiff's attorneys in which the researcher served as an expert witness. Data are frequently presented as evidence in litigation involving sexual and racial discrimination. Its significance was recently dramatized in a case (Melani v. Board of Higher Education of the City of New York); only statistics without any other evidence proved intentional sexual discrimination.

The significance of the difference between two independent proportions was the statistical procedure used to determine if significant differences between females and males as well as black and whites occured. For each analysis conducted regarding gender (e.g. all applicants offered employment with the GPD from 1980 to 1982) the proportion of males was greater than the proportion of females, $p < .05$. However, only a few analyses investigating racial differences revealed that the proportion of whites was greater than the proportion of blacks using

an .05 probability level as the criterion for significance. For instance data indicated that the proportion of white members of the GPD was greater than the proportion of black members of the GPD, $p < .05$.

The Presentation of Statistical Analysis of Data as Evidence in Litigation Involving Sexual and Racial Discrimination

Since the United States Supreme Court has upheld the use of statistics in proving or disproving employment discrimination, data frequently are presented as evidence in litigation (Hay, 1978). For instance in the case, Polstorff v. Fletcher, an Alabama federal district court maintained that age discrimination was substantiated by statistics. Additionally, the importance of statistical evidence was recently dramatized in Melani v. Board of Higher Education of the City of New York; only statistics without any other evidence proved intentional sexual discrimination.

This paper concerning sexual and racial discrimination litigation serves two primary functions. First, an illustration of how data was analyzed statistically and, second, actually presented by plaintiff's attorneys in the case, Green v. City of Gadsden, in which the researcher served as an expert witness is revealed.

METHOD

Subjects

Since an individual must be 21 years old to be a member of the Gadsden Police Department (GPD) and percentage variations in the sexual and racial compositions of other population statistics (e.g. population of Etowah County) from which members of the GPD could be recruited were essentially nonexistant, the population of Gadsden, Alabama based on the 1980 census for people 21 years and older was considered as the proper geographical scope of statistical evidence upon which some analyses were based. This consideration appears most important because both plaintiffs and defendants using different population groups and/or time periods provided support for discriminatory and nondiscriminatory practices

(McCarthy and Cambron, 1981). Additional data submitted by the City of Gadsden in response to interrogatories by plaintiff's attorneys were used in the statistical analyses (see Table 1).

Insert Table 1 about here

Hypotheses

Fourteen null hypotheses constituting the basis for the statistical analyses in this study were tested.

Null Hypothesis I

The proportion of male members of the GPD equals the proportion of female members of the GPD.

Null Hypothesis II

The proportion of black members of the GPD equals the proportion of white members of the GPD.

Null Hypothesis III

The proportion of male GPD examinees from 1980 to 1982 equals the proportion of female GPD examinees from 1980 to 1982.

Null Hypothesis IV

The proportion of black GPD examinees from 1980 to 1982 equals the proportion of white GPD examinees from 1980 to 1982.

Null Hypothesis V

The proportion of males passing the GPD entry level law enforcement examination from 1980 to 1982 equals the proportion of females passing the GPD entry level law enforcement examination from 1980 to 1982.

Null Hypothesis VI

The proportion of blacks passing the GPD entry level law enforcement examination from 1980 to 1982 equals the proportion of whites passing the GPD entry level law enforcement examinations from 1980 to 1982.

Null Hypothesis VII

The proportion of males passing the GPD exam either before or after 1980 who were employed by the GPD from 1980 to 1982 equals the proportion of females passing the GPD exam during the same time frame who were employed by the GPD from 1980 to 1982.

Null Hypothesis VIII

The proportion of blacks passing the GPD exam before or after 1980 who were employed by the GPD from 1980 to 1982 equals the proportion of the whites passing the GPD exam before or after 1980 who were employed by the GPD from 1980 to 1982.

Null Hypothesis IX

The proportion of males passing the GPD exam from 1980 to 1982 who were employed by the GPD during the aforesaid time period equals the proportion of females passing the GPD exam from 1980 to 1982 who were employed by the GPD during the aforementioned time period.

Null Hypothesis X

The proportion of blacks passing the GPD exam from 1980 to 1982 who were employed by the GPD during the aforesaid time period equals the proportion of whites passing the GPD exam from 1980 to 1982 who were employed by the GPD during the aforementioned time period.

Null Hypothesis XI

The proportion of males passing the GPD exam before or after 1980 who were offered employment by the GPD from 1980 to 1982 equals the proportion of females passing the GPD exam before or after 1980 who were offered employment by the GPD from 1980 to 1982.

Null Hypothesis XII

The proportion of blacks passing the GPD exam before or after 1980 who were offered employment from 1980 to 1982 by the GPD equals the proportion of whites passing the GPD exam before or after 1980 who were offered employment by the GPD from 1980 to 1982.

Null Hypothesis XIII

The proportion of males passing the GPD exam from 1980 to 1982 who were offered employment by the GPD during the aforesaid time period equals the proportion of females passing the GPD exam from 1980 to 1982 who were offered employment by the GPD during the aforementioned time period.

Null Hypothesis XIV

The proportion of blacks passing the GPD exam from 1980 to 1982 who were offered employment by the GPD during the aforesaid time period equals the proportion of whites passing the GPD exam from 1980 to 1982 who were offered employment by the GPD during the aforementioned time period.

Research Design

Both males and females as well as blacks and whites constitute two independent populations in which proportions are obtainable. Thus, the significance of the difference between two independent proportions (Ferguson, 1976) was selected as the appropriate statistical procedure to test each null hypothesis. A .05 probability level was the criterion for significance.

RESULTS

Null Hypothesis I

The GPD sexual composition was 92% male and eight percent female (see Figure 1).

Insert Figure 1 about here

Using the population of Gadsden as the comparison basis 70 men out of 10,000 males were members of the GPD; only five women per 10,000 females within the same geographical area were GPD members (see Figure 2).

Insert Figure 2 about here

Since the proportion of male members of the GPD (.0070) was greater than the proportion of female GPD members (.0005), $p < .0002$, null hypothesis I was rejected.

Null Hypothesis II

The racial composition of the GPD was seven percent black and 93% white (see Figure 1). Using the racial stratification of the Gadsden population as the statistical frame of reference 12 blacks for every 10,000 blacks and 40 whites for every 10,000 whites were members of the GPD (see Figure 2). Since the proportion of whites on the GPD (.0040) was statistically greater than the

proportion of black GPD members (.0012), p = .0004, null hypothesis II was rejected.

Null Hypothesis III

Again using the sexual composition of the Gadsden population as the comparison basis 16 men per 1,000 males took the GPD written entry level law enforcement examination in contrast to only six women per 1,000 females taking the same exam (see figure 3).

Insert Figure 3 about here

Since the proportion of male GPD examinees (.016) was significantly larger than the proportion of GPD female examinees (.006), p < .0002, null hypothesis III rejected.

Null Hypothesis IV

Using the racial stratification of the Gadsden population as the statistical basis, eight blacks per 1,000 blacks took the GPD written entry level law enforcement exam in contrast to 11 whites per 1,000 whites taking this examination (see Figure 3). Since the proportion of white GPD examinees (.011) was statistically larger than the proportion of black GPD examinees (.008), p= .04, null hypothesis IV was rejected.

Null Hypothesis V

Utilizing the sexual composition of the examinees taking the GPD written entry level law enforcement examination as the comparison basis, 60 men per 100 males passed the exam from 1980 to 1982 in contrast to 49 women per 100 females passing the same exam during the aforesaid years. (see Figure 4).

Insert Figure 4 about here

Since the proportion of males passing the GPD exam (61%) was significantly larger than the proportion of females passing this exam (49%), p= .04, null hypothesis V was rejected.

Null Hypothesis VI

Utilizing the racial stratification of the examinees taking the GPD written entry level law enforcement examination as the statistical frame of reference 30 blacks per 100 blacks passed the exam from 1980 to 1982 in contrast to 62 whites per 100 whites passing this exam during the same years (see Figure 4). Since the proportion of whites passing the GPD exam (62%) was statistically larger than the proportion of blacks passing this exam (30%), $p < .0002$, null hypothesis VI was rejected.

Null Hypothesis VII

Using the sexual composition of the examinees passing the GPD written exam from 1980 to 1982 as the comparison basis, a total of 19 men who passed the GPD exam either before or after 1980 per 100 males were employed by the GPD from 1980 to 1982 in contrast to a total of two women who passed this exam before or after 1980 per 100 females employed by the GPD from 1980 to 1982 (see Figure 5).

Insert Figure 5 about here

Since the proportion of males employed by the GPD during the aforementioned time period (.19) was significantly larger than the proportion of females employed by the GPD during the same years (.02), p= .0016, null hypothesis VII was rejected.

Null Hypothesis VIII

Using the racial stratification of the examinees passing the GPD written exam from 1980 to 1982 as the comparison basis, a total of 18 blacks passing the GPD exam before or after 1980 per 100 blacks were employed by the GPD from 1980 to 1982 in contrast to a total of 13 whites passing the GPD exam before or after 1980 per 100 whites employed by the GPD from 1980 to 1982 (see Figure 5). Even though the proportion of blacks employed by the GPD during the aforementioned time period (.18) was larger than the proportion of whites employed by the GPD during the same years (.13), the probability of the difference between these two independent proportions was not determined for the following reason. The appropriate guideline indicated by Ferguson (1976) was not fulfulled in order to interpret the resulting Z value in reference to the normal curve. Thus, it was not appropriate to test null hypothesis VIII.

Null Hypothesis IX

Using the sexual composition of the examinees passing the GPD written exam from 1980 to 1982 as the comparison basis, only 12 men who passed this exam during the aforesaid time period out of 100 males were employed during these years. In contrast to no women who passed the GPD exam from 1980 to 1982 were employed at this time (see Figure 6).

Insert Figure 6 about here

Since the proportion of males passing the exam from 1980 to 1982 and also employed at this time (12%) was significantly larger than the proportion of females passing the exam as well as employed during the aforementioned time (0%), $p=.006$, null hypothesis IX was rejected.

Null Hypothesis X

Using the racial stratification of the examinees passing the GPD written exam from 1980 to 1982 as the comparison basis, 18 blacks who passed this GPD exam during the aforesaid time period out of 100 blacks were employed during the same time frame. In contrast only eight whites who passed the GPD exam from 1980 to 1982 out of 100 whites were employed at this time (see Figure 6). Even though the proportion of blacks passing the exam from 1980 to 1982 and also employed at this time (18%) was larger than the proportion of whites passing the exam as well as employed at the aforesaid time (8%), it was inappropriate to interpret the resulting Z value in reference to the normal curve. Since the guideline indicated by Ferguson (1976) was not maintained, null hypothesis X was not tested.

Null Hypothesis XI

Using the sexual composition of the examinees passing the GPD written exam from 1980 to 1982 as the comparison basis, a total of 29 men who passed the GPD exam before or after 1980 per 100 males were offered employment by the GPD from 1980 to 1982 in contrast to a total of ten women who passed the GPD exam before or after 1980 per 100 females offered employment by the GPD from 1980 to 1982 (see Figure 7).

Insert Figure 7 about here

Since the proportion of males offered employment by the GPD during the aforementioned time period (29%) was significantly larger than the proportion of females offered employment by the GPD during the same years (10%), $p=.004$, null hypothesis XI was rejected.

Null Hypothesis XII

Using the racial stratification of the examinees passing the GPD written exam from 1980 to 1982 as the comparison basis, a total of 29 blacks passing the GPD exam before or after 1980 per 100 blacks were offered employment by the GPD from 1980 to 1982 in contrast to a total of 23 whites passing the GPD exam before or after 1980 per 100 whites offered employment by the GPD from 1980 to 1982 (see Figure 7). Even though the proportion of blacks offered employment by the GPD during the aforementioned time period (29%) was larger than the proportion of whites offered employment during the same years (23%), the chance probability of the difference between these two independent proportions was not determined. Since the guideline indicated by Ferguson (1976) was not maintained, it was inappropriate to interpret the resulting Z value in reference to the normal curve (i.e., test null hypothesis XII).

Null Hypothesis XIII

Using the sexual composition of the examinees passing the GPD written exam from 1980 to 1982 as the comparison basis, 20 men who passed this exam during the aforesaid time period out of 100 males were offered employment during these years. In contrast only seven women who passed the GPD exam from 1980 to 1982 out of 100 females were offered employment at this time (see Figure 8).

Insert figure 8 about here

Since the proportion of males passing the exam from 1980 to 1982 and also offered employment at this time (20%) was significantly larger than the proportion of females passing the exam as well as offered employment during the aforesaid time (7%), $p=.02$, null hypothesis XIII was rejected.

Null Hypothesis XIV

Using the racial stratification of the examinees passing the GPD written exam from 1980 to 1982 as the comparison basis, 29 blacks who passed this GPD exam during the aforesaid time period out of 100 blacks were offered employment during the same time frame. In contrast only 15 whites who passed the GPD exam from 1980 to 1982 out of 100 whites were offered employed at this time (see Figure 8). Even though the proportion of blacks passing the exam from 1980 to 1982 and also offered employment at this time (29%) was larger than the proportion of whites passing tha exam as well as offered employment at the aforesaid time (15%) the chance probability of the difference between these two independent proportions was not determined. Since the guideline indicated by Ferguson (1976) again was not maintained, it was inappropriate to interpret the resulting Z value in reference to the normal curve (i.e., test null hypothesis XIV).

Additionally several frequency distributions indicating primarily the number of individuals by sex and race who obtain a specific passing score on the GPD exam from 1980 to 1982 is presented. A separate column in the frequency distributions reveals the number of people by sex and race obtaining the specific passing score that were hired (see Table 2).

Insert Table 2 about here

CONCLUSION

After tendering the researcher as an expert witness, plaintiff's attorneys proffered the aforementioned figures and table as evidence. Although the expert witness was instructed to state only his findings rather than draw inferences, the data analyses were designed to reflect on several issues involved in this case. Figures one and two reveal primarily the results of past sexual and racial GPD employment practices. The effects of recent recruitment practices of the GPD are depicted in figure three. Assuming the entry level law enforcement examination

was invalid, figure four would reflect upon the sexual and racial bias characterized by this examination. If this written GPD exam were valid, then figure four might reasonably be interpreted as indicating that only a limited number of qualified females and blacks were available for the GPD to employ. Since the plaintiff obtained a passing score on the examination, supra, the judge ruled that the validity of this examination was not an issue in this case. Thus, he did not allow either figure three or figure four to be introduced as exhibits. Figure five pertains to the effect of current sexual and racial GPD employment practices, regardless of when examinees passed the written examination. The same analysis of the effect of the current sexual and racial GPD employment practices was revealed in figure six; however, it was based on a different time period as to when examinees passed the exam (i.e., 1980 to 1982). Figure seven reflects upon the active participation of the GPD in sexual and racial discriminatory employment practices regardless of when examinees passed the written examination. The same analysis involving the active participation of the GPD in sexual and racial discriminatory employment practices was revealed in figure eight. However, it was based on the time period of examinees passing the exam from 1980 to 1982. Since the United States Supreme Court in the recent case, Guardians Association v. Civil Service Commission of the City of New York, ruled that the plaintiff must prove intentional discrimination in order to recieve back pay, the analysis of data as presented in figures seven and eight would be of paramount importance in cases of this type. Data as presented in Table two provided a sexual and racial comparison on an individual rather than group basis in terms of actual employment by the GPD.

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6. McCarthy, Martha M. & Cambron, Nelda H. Public School Law: Teachers' and Students' Rights. Boston: Allyn & Bacon, 1981.

7. Polstorff v. Fletcher, 452 F. Supp. 17 (N.D. Ala. 1978).

TABLE 1

Actual Data Used in Statistical Analyses

	Male	Female	Black	White	Total
Gadsden, Alabama Population 21 Years and Older Based on 1980 Census	14,461	18,438	6,733	26,001	32,899
GPD Members (1982)	102	9	8	103	111
Examinees "Taking" the GPD Entry Level Law Enforcement Written Exam (1980 - 1982)	232	120	57	295	352
Examinees "Passing" the GPD Entry Level Law Enforcement Written Exam (1980 - 1982)	140	59	17	182	199
Applicants Passing the Written Exam Before or After 1980 "Employed" by the GPD (1980 - 1982)	26	1	3	24	27
Applicants Passing the Written Exam only During 1980 to 1982 "Employed" by the GPD (1980 - 1982)	17	0	3	14	17
Applicants Passing the Written Exam Before or After 1980 "Offered Employment" by the GPD (1980 - 1982)	41	6	5	42	47
Applicants Passing the Written Exam only During 1980 - 1982 "Offered Employment" by the GPD (1980 - 1982)	28	4	5	27	32

TABLE 2

Frequecny Distributions

for

All Examinees (comtined) passing Gadsden Police Exam and

Sexual and Racial groupings with passed and hired frequencies

(1980 to 1982)

		Male		Female		Black		White	
		passed	hired	passed	hired	passed	hired	passed	hired
Raw Score	f	f	f	f	f	f	f	f	f
64	1	0		1	0	0		1	0
63	0	0		0	0	0		0	0
62	1	1	1	0	0	0		1	1
61	4	3	0	1	0	0		4	0
60	1	1	1	0	0	0		1	1
59	5	4	1	1	0	0		5	1
58	8	7	1	1	0	0		8	1
57	4	4	2	0	0	0		4	2
56	12	6	1	6	0	0		12	1
55	13	8	0	5	0	0		13	0
54	11	8	2	3	0	0		11	2
53	13	12	1	1	0	0		13	1
52	9	7	1	2	0	2	1	7	0
51	15	10	2	5	0	0	0	15	2
50	12	9	1	3	0	2	0	10	1
49	14	11	1	3	0	1	0	13	1
48	16	12	1	4	0	2	1	14	0
47	11	5	0	6	0	1	0	10	0
46	8	3	0	5	0	2	0	6	0
45	11	8	0	3	0	1	0	10	0
44	11	8	0	3	0	1	0	10	0
43	6	3	0	3	0	3	0	3	0
42	11	8	0	3	0	1	0	10	0
41	2	2	1	0	0	1	1	1	0
	199	140	17	59	0	17	3	182	14

FIGURE 1

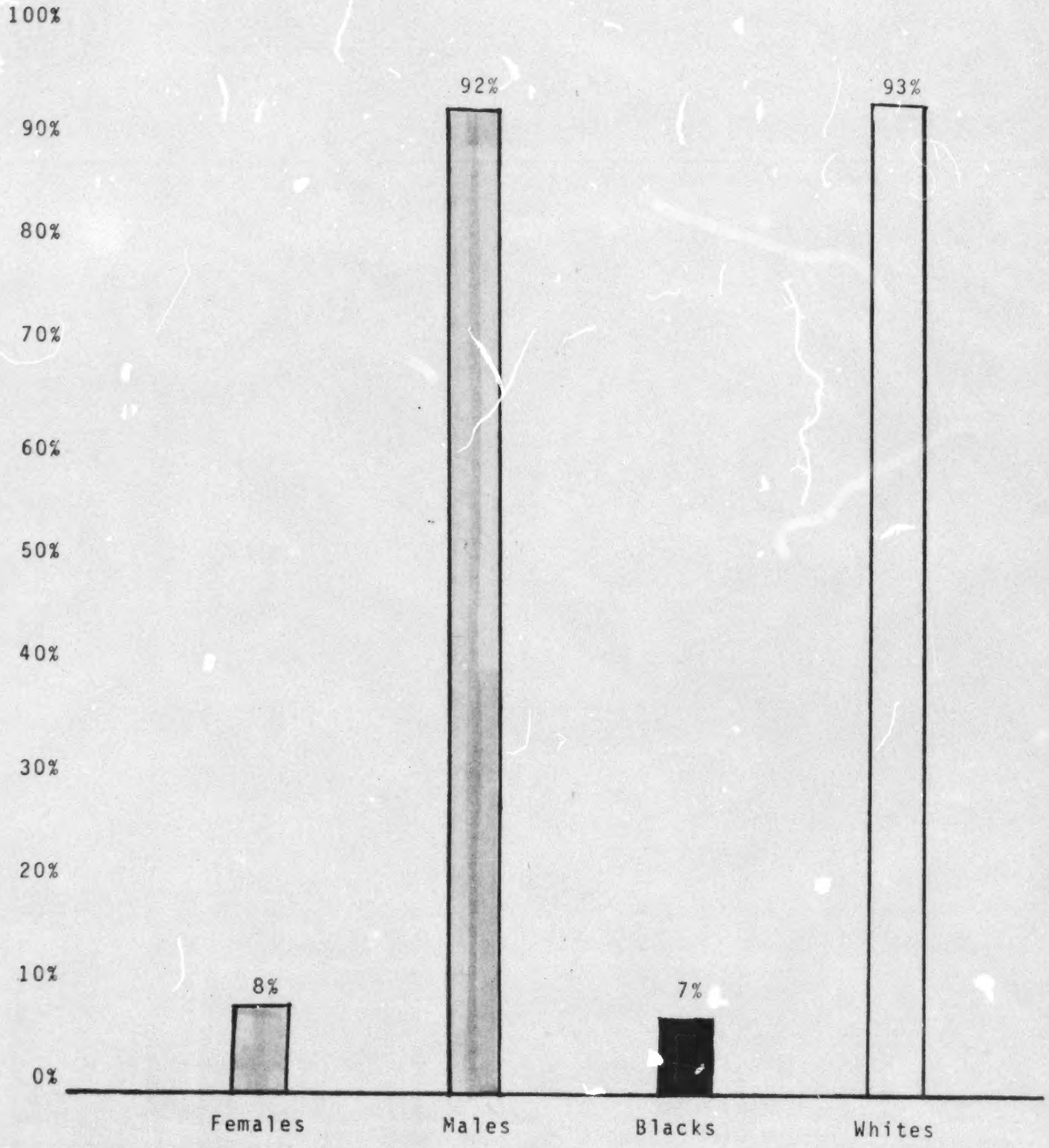

Figure 1: Sexual and Racial Composition of the Gadsden Police Department (GPD)

FIGURE 2

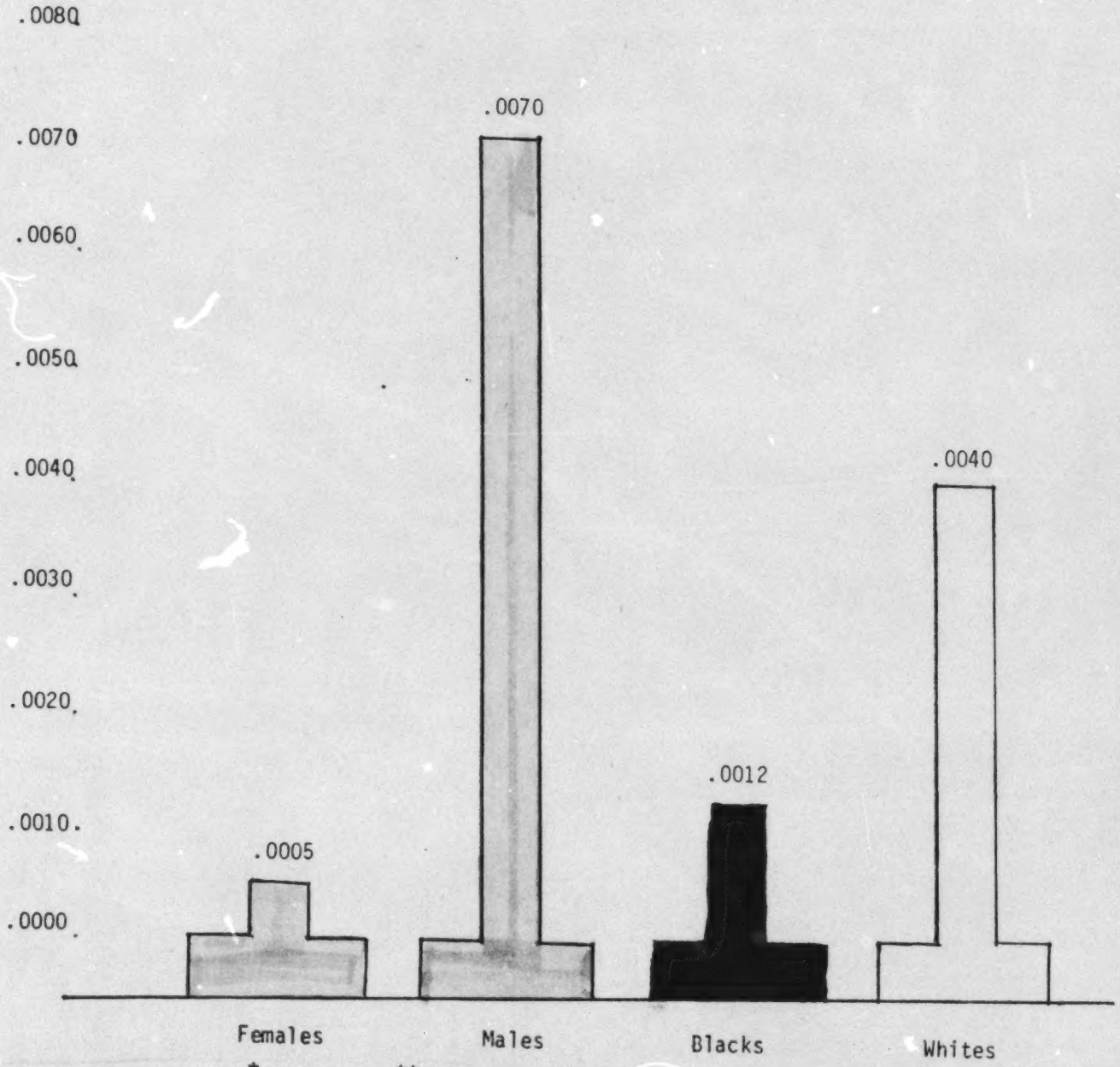

Figure 2: Sexual* and Racial** Composition of the GPD in Relation to their Respective Group within the City of Gadsden Population

*
** $p < .0002$
$p = .0004$

FIGURE 3

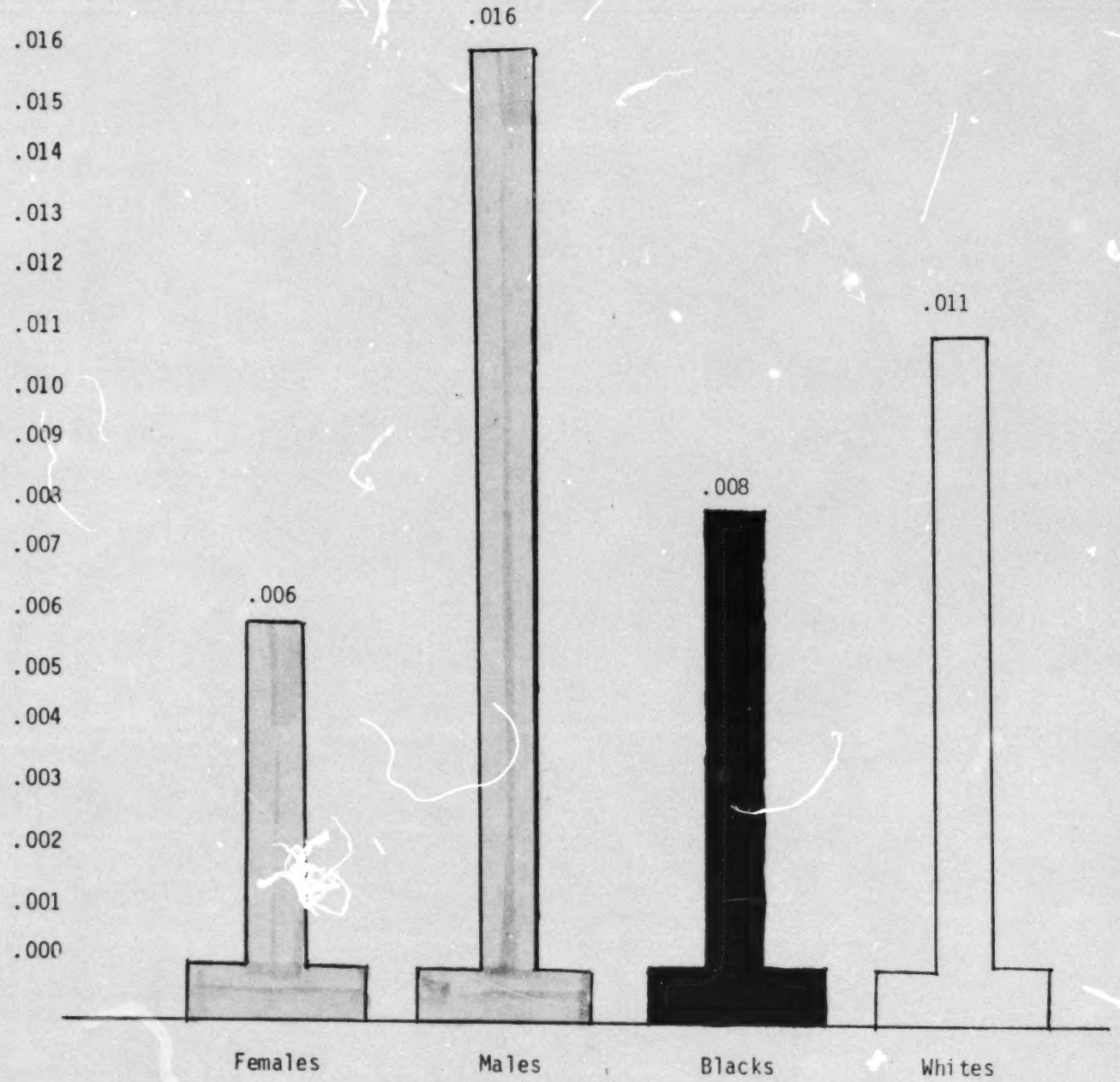

Figure 3: Sexual* and Racial** Composition of Examinees taking the GPD Entry Level Law Enforcement Written Examination from 1980 to 1982 in Relation to their Respective Group within the City of Gadsden Population

* $p \leq .0002$
** $p = .04$

FIGURE 4

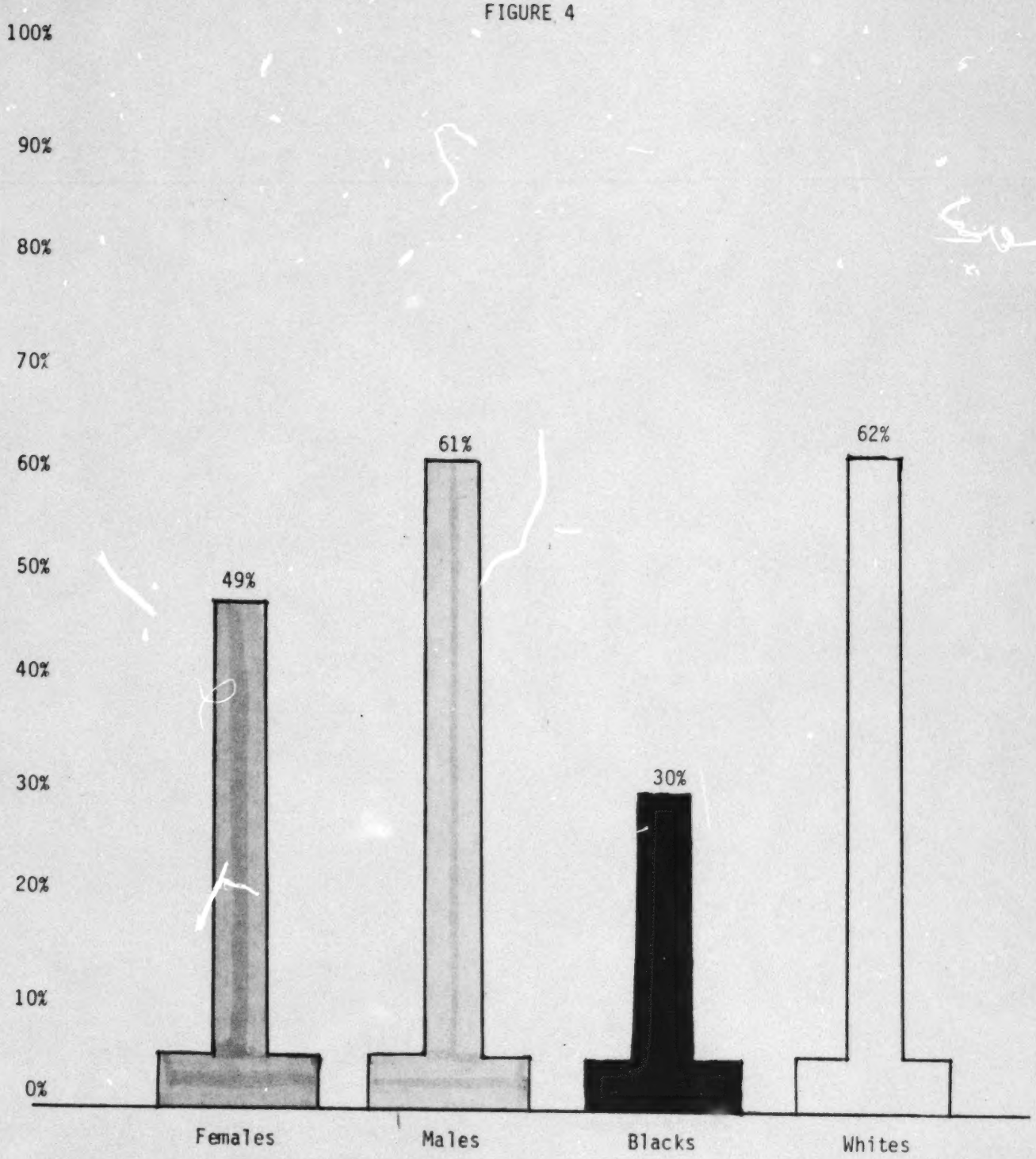

Figure 4: Sexual* and Racial** Conposition of Examinees Passing the GPD Exam from 1980 to 1982 in Relation to their Respective Group taking this Examination during the aforesaid Years

*
** $p = .04$
$p < .0002$

FIGURE 5

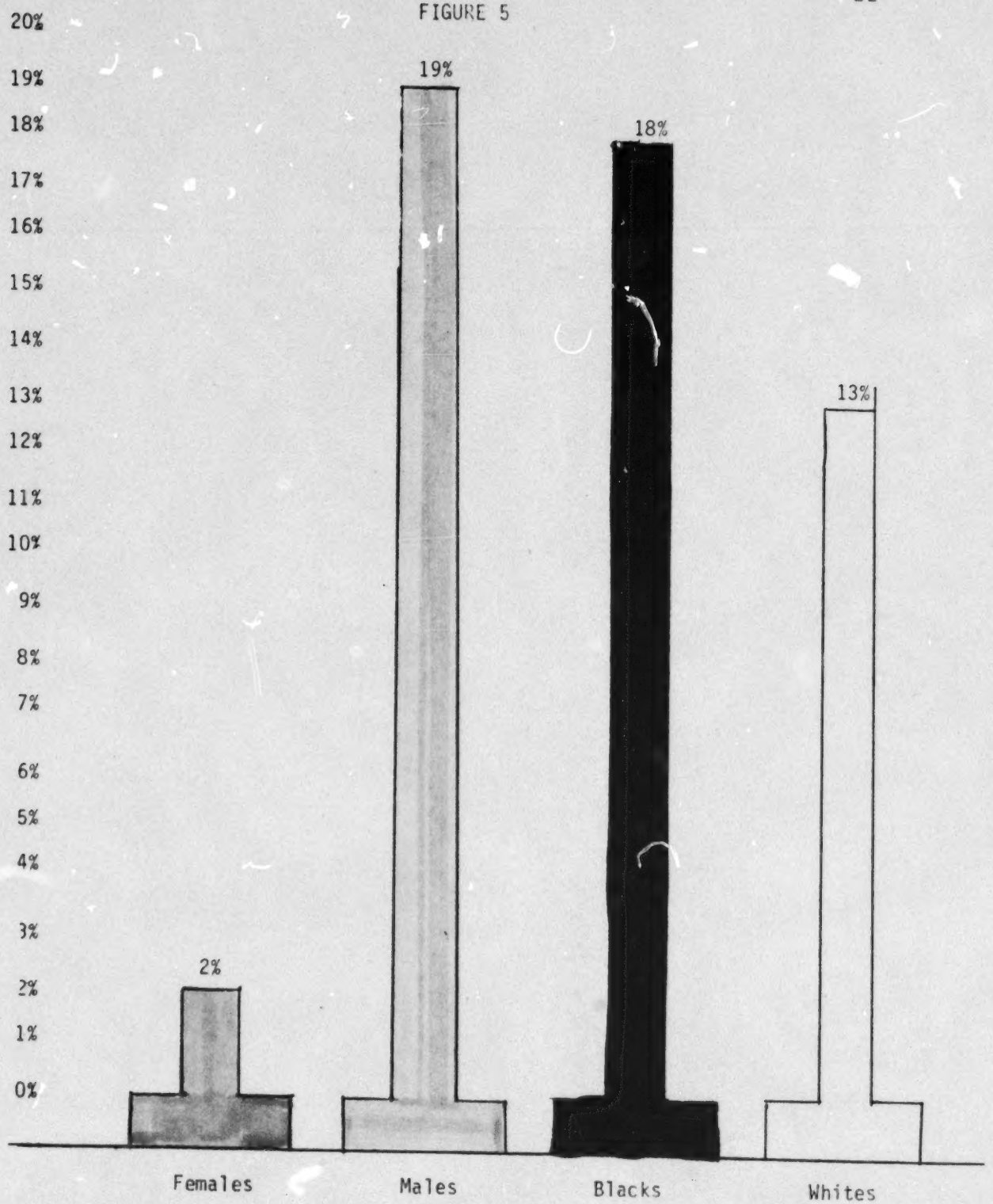

Figure 5: Sexual* and Racial** Composition of Examinees Passing the GPD Exam before or after 1980 who were Employed with the GPD from 1980 to 1982 in Relation to their Respective Group Passing the GPD Exam from 1980 to 1982

*
** p = .0016
inappropriate to interpret resulting Z value in reference to the normal curve

FIGURE 6

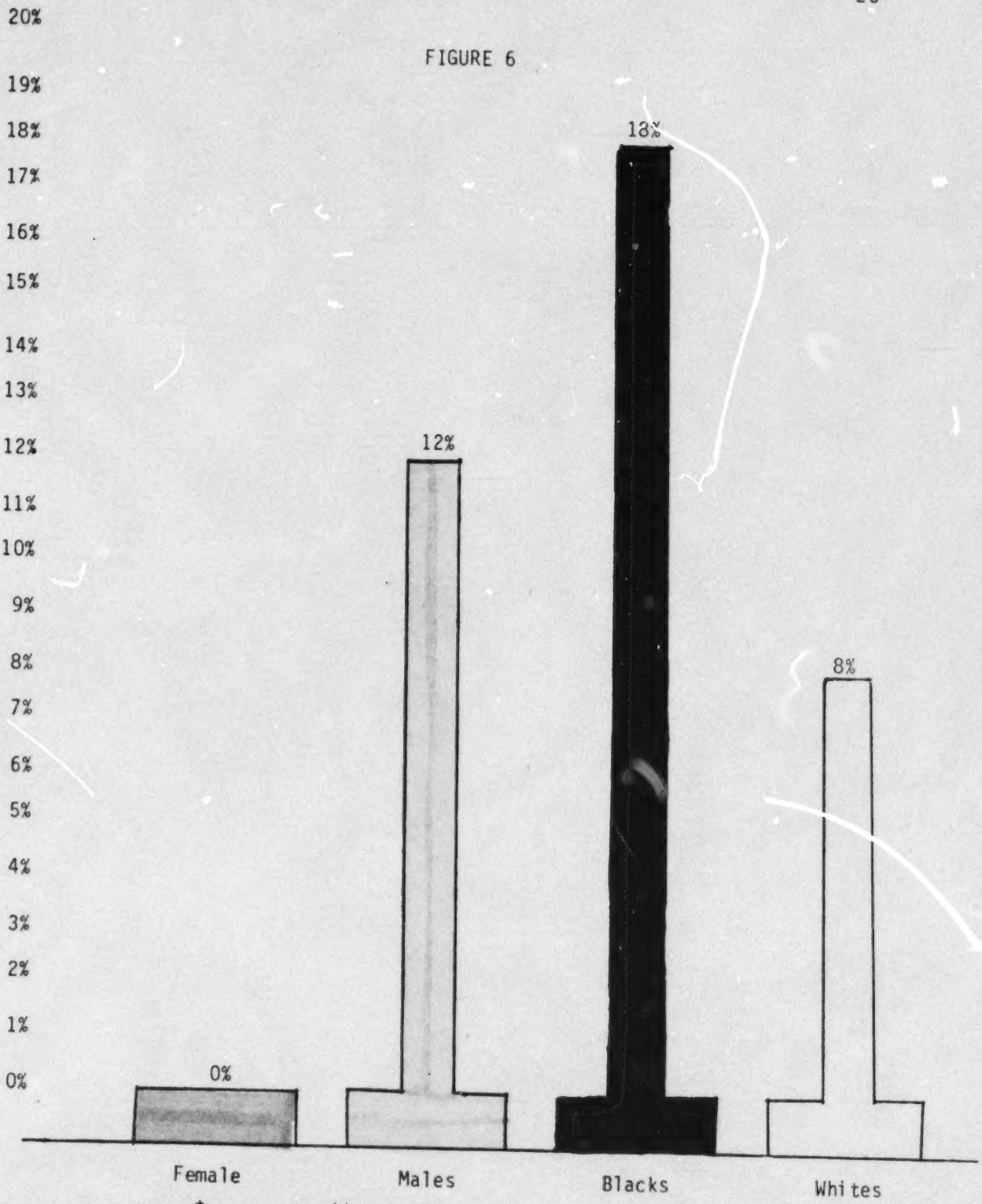

Figure 6: Sexual* and Racial** Composition of Examinees Passing the GPD Exam from 1980 to 1982 who were Employed with the GPD during these Years in Relation to their Respective Group Passing the Exam at this Time

*
** $p = .006$
inappropriate to interpret resulting Z value in reference to the normal curve

FIGURE 7

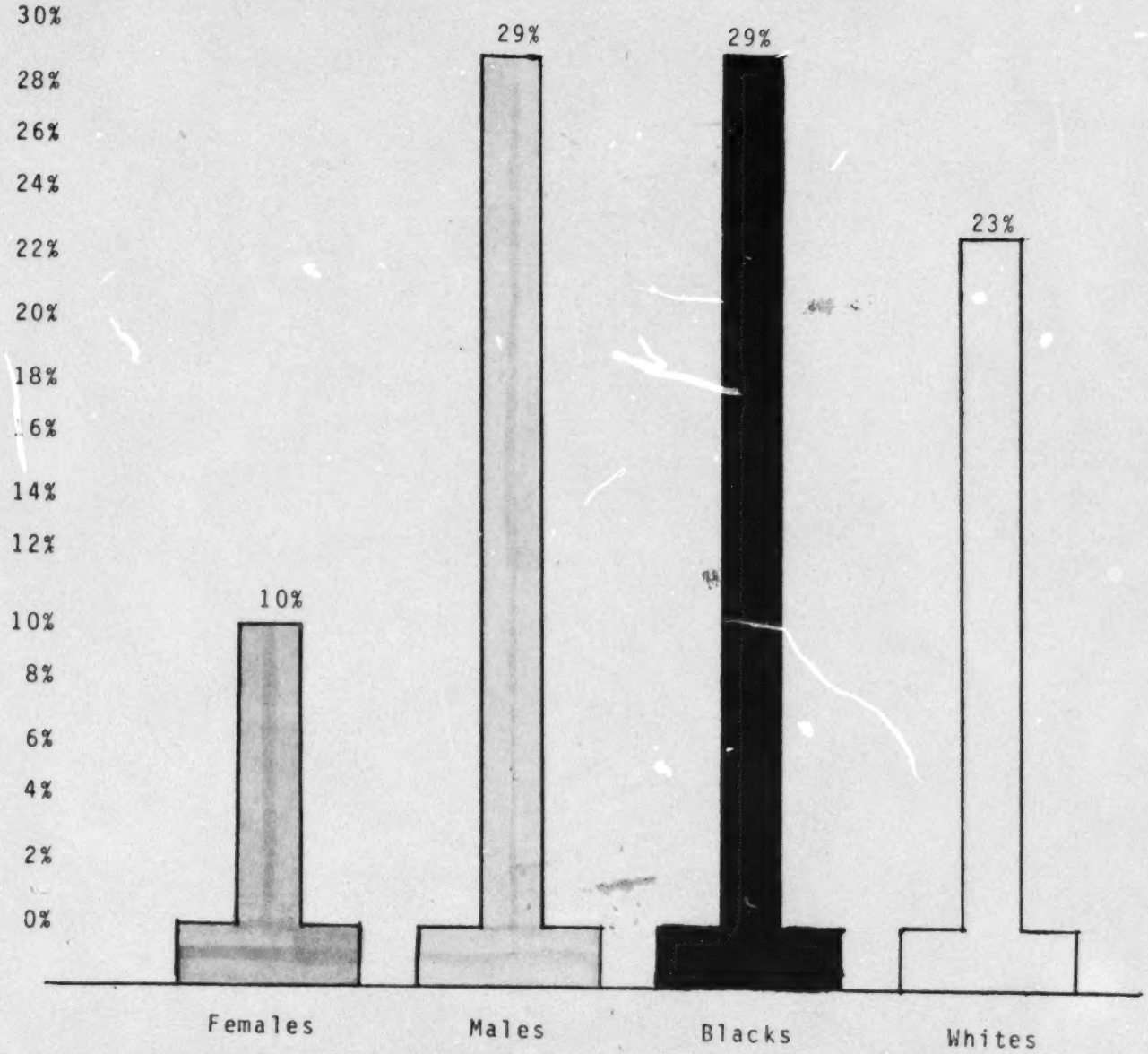

Figure 7: Sexual* and Racial** Composition of Examinees Passing the GPD Exam before or after 1980 offered Employment with the GPD from 1980 to 1982 in Relation to their Respective Group Passing the GPD Exam from 1980 to 1982

*
** p = .004
Inappropriate to interpret resulting Z value in reference to the normal curve

FIGURE 8

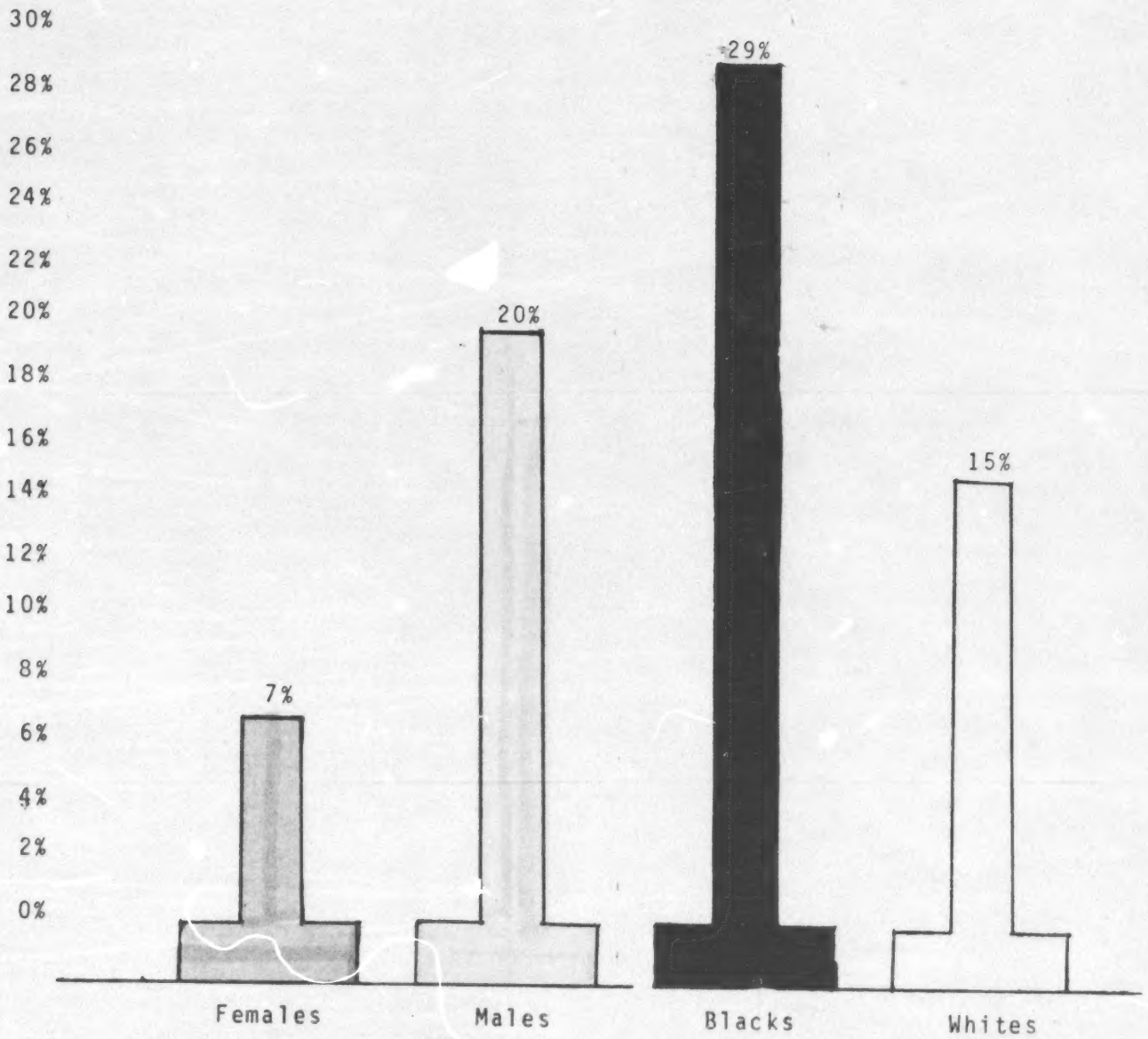

Figure 8: Sexual* and Racial** Composition of Examinees Passing the GPD Exam from 1980 to 1982 who were Offered Employment with the GPD during these Years in Relation to their Respective Group Passing the Exam at this Time

* p = .02

** inappropriate to interpret resulting Z value in reference to the normal curve